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Idiomysis bumbumiensis sp. nov., a new mysid species (Mysida, Mysidae, Anisomysini) from Southeast Asia

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Abstract

We provide a detailed description, including illustrations, of a new species of mysid belonging to the genus *Idiomysis* W. M. Tattersall, 1922 from Pulau Bum Bum, Sabah, Malaysia. The presence of two segments of antennal scale, a shorter endopod of uropod than the exopod and a pair of minute spines at the apex of the telson distinguishes *Idiomysis bumbumiensis* sp. nov. from all other species in the genus. The present species is the seventh member of the genus *Idiomysis* and it is the first described in Southeast Asia. It is also the third species of tribe Anisomysini discovered in Malaysian waters. We include an updated dichotomous key of all *Idiomysis* species.

Key Words

Pulau Bum Bum, *Idiomysis*, Malaysia, new species, Sabah

Introduction

Mysids are considered as one of the most abundant and widely distributed crustaceans in the world, are known to inhabit all aquatic areas, but they are predominantly found in marine environments (Gan et al. 2010). Wittmann et al. (2014) established the tribe Anisomysini (former Mysini) for the first time, encompassing seven genera; *Anisomysis* Hansen, 1910; *Carnegieomysis* W. M. Tattersall, 1943; *Halemysis* Băcescu & Udrescu, 1984; *Idiomysis* W. M. Tattersall, 1922; *Javanisomysis* Băcescu, 1992, *Mysidium* Dana, 1852 and *Paramesopodopsis* Fenton, 1985. Today, six species of *Idiomysis* have been recorded from various locations. They include *Idiomysis diadema* Wittmann, 2016 from the coast of Dahab, Red Sea; *Idiomysis inermis* W. M. Tattersall, 1922 from Kilakarai, Gulf of Manaar, India; *Idiomysis japonica* Murano, 1978 from Nomo, Nagasaki, Japan; *Idiomysis mozambicus* Deprez, Wooldridge & Mees, 2001 from Nacala Bay, Mozambique, South Africa; *Idiomysis robusta* Connell, 2008 from the east coast of South Africa; and *Idiomysis tsurnamali* Băcescu, 1973 from Gulf of Elat, Red Sea. Some species (*Idiomysis japonica*, *I. mozambica* and *I. robusta*) are free-living by nature (Murano 1978; Deprez et al. 2001; Connell 2008), while some others (*Idiomysis diadema*, *I. inermis* and *I. tsurnamali*) associate with other organisms, such as sea anemones and sea urchins (Băcescu 1973; Greenwood and Hadley 1982; W. M. Tattersall 1922; Bhaduri and Crowther 2016; Wittmann 2016). Numerous species of mysids from the tribe Anisomysini have been discovered in Southeast Asian waters (Sawamoto 2014). To date, only two species, namely *Anisomysis* (*Anisomysis*) *aikawai* Ii, 1964 and *A.* (*Paranisomysis*) *ohtsukai* Murano, 1994, have been identified from Malaysian waters (Gan et al. 2010; Tan et al. 2014; Moriya 2016; Tan and Azman 2018) and there was no record of any mysid of the genus *Idiomysis*.

Pulau Bum Bum is situated in the Semporna District of southeast Sabah, an East Malaysian State. It is a con-

stituent of the Sulu Sulawesi Marine Ecoregion (SSME) and Coral Triangle Initiative (CTI), making it one of the richest marine biodiversity territories in the world (Ho and Kassem 2009). The most recent discovery was the newly-described *Cerapus bumbumiensis* Nurshazwan, Ahmad-Zaki & Azman, 2020, collected from Pulau Bum Bum (Nurshazwan et al. 2020). Even though this location is well-known for its extraordinary marine life diversity, there is little information on reef-associated crustacean fauna, including mysids. The present study described and identified *Idiomysis bumbumiensis* sp. nov. as a new species from Pulau Bum Bum, Sabah, Malaysia.

Materials and methods

The specimens were collected using SCUBA diving equipment on a silty substrate near a large coral ledge of ND Divers House Reef, Pulau Bum Bum in Semporna, Sabah of East Malaysia (Fig. 1). Specimens were initially fixed with a 4% formaldehyde-seawater solution and subsequently preserved with 85% ethyl alcohol after sorting in the laboratory. The body length of the mysids was measured in the laboratory from the tip of the rostrum to the end of the telson, excluding apical spines. Appendages were dissected using a stereomicroscope (Olympus SZX9) and mounted on a temporary slide with a glycerol-ethanol mixed solution for illustrative purposes. An optical microscope (Olympus BX43), equipped with a camera lucida, visualised the images. They were then pencil-drawn and digitised in Adobe Illustrator CS6 following guidelines by Coleman (2003). The terminology used was according to Wittmann et al. (2014). All specimens were deposited in the Universiti Kebangsaan Malaysia Muzium Zoologi (UKMMZ), Bangi, Malaysia.

Results

Systematics

***Idiomysis bumbumiensis* sp. nov.**

http://zoobank.org/BA9ADF20-A7DB-4C50-B301-D3036F77925B

Figs 2–6

Type material. Holotype, adult male (BL. 2.3 mm, UKMMZ-1611); Allotype, ovigerous female (BL. 3.2 mm, UKMMZ-1612); Paratypes, two males (BL. 2.0 and 2.2 mm), one female (BL. 2.2 mm) (UKMMZ-1613); two females (BL. 2.6 and 3.1 mm, UKMMZ-1614), ND Divers House reef, Pulau Bum Bum, Semporna, Sabah, Malaysia, 4°26'43.2"N, 118°39'08.1"E, SCUBA diving, 29 November 2018, 10.5 m depth, collectors: Abu-Bakar A.Z., Azman B.A.R. and Dendy A.O.

Diagnosis. Antennal scale 2-segmented, with short apical segment, scale without any spine; rostrum subtriangular with broad rounded apex; thoracic exopod 1–8 with 7–9 segments; thoracic endopod 1–2 robust, thoracic endopod 3–8 elongate; all pleopods longer than wide; fourth male pleopod with distinct exopod and endopod not separated by sutures at the base, exopod terminally with 1 large barbed seta (armed with a few setules); en-

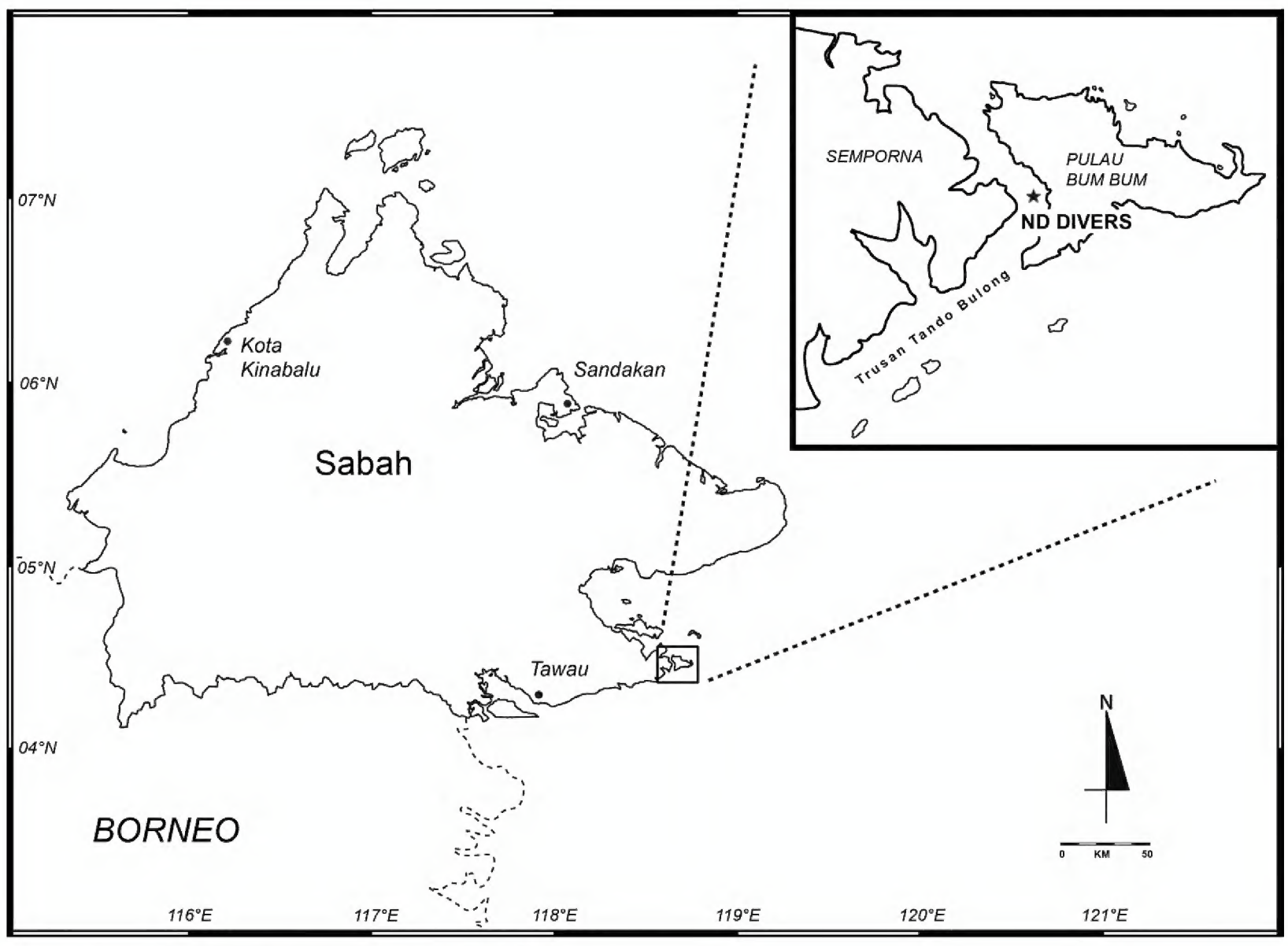

Figure 1. Map of Pulau Bum Bum, Semporna, Sabah, Malaysia

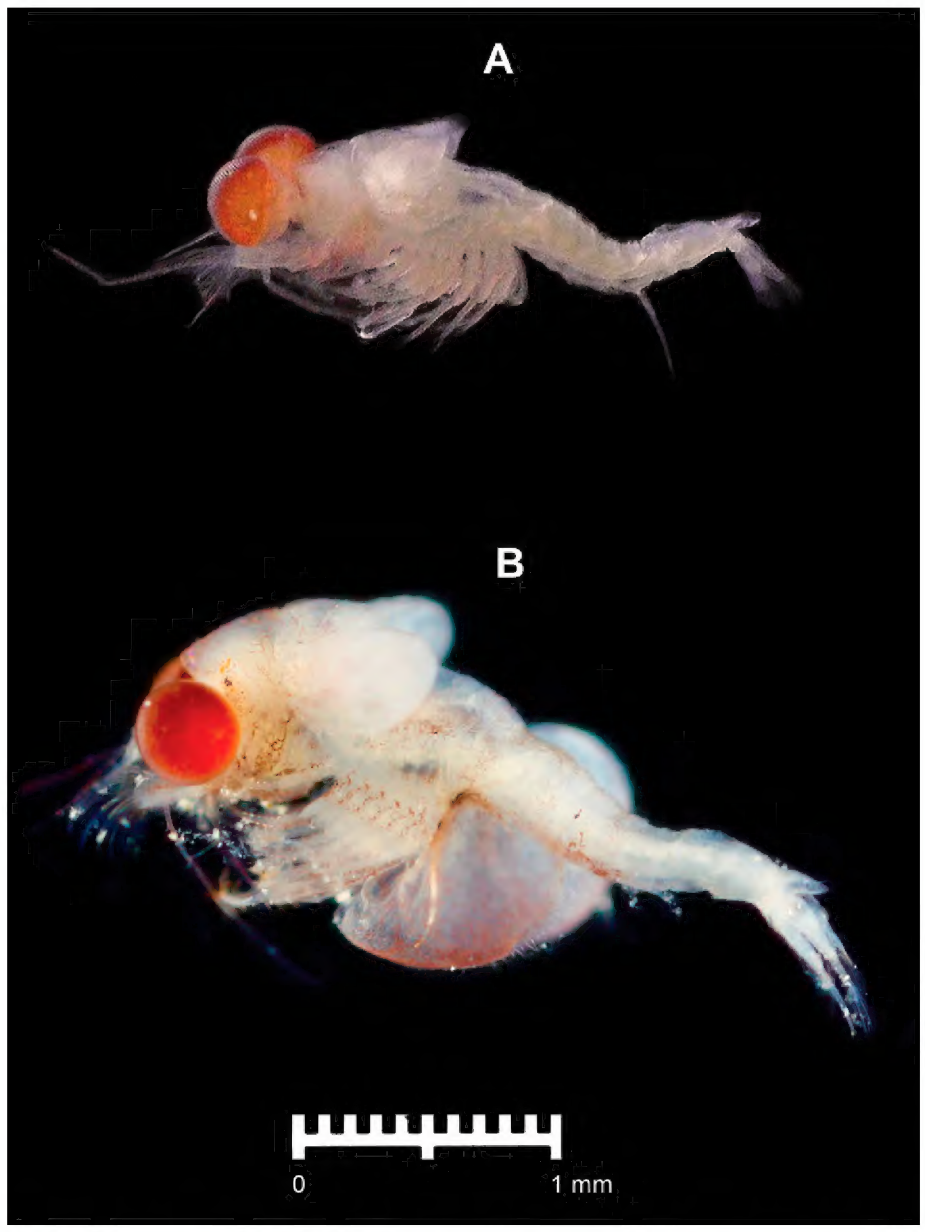

Figure 2. *Idiomysis bumbumiensis* sp. nov. (freshly fixed), **A.** Lateral view of the holotype (BL. 2.3 mm, UKMMZ-1611); **B.** Lateral view of allotype (BL. 3.2 mm, UKMMZ-1612).

dopod of uropod shorter than exopod; telson with a pair of minute spines on terminal margin; telson length ratio to sixth abdominal somite is 0.8.

Description for male. Head and cephalic appendage. A pale-white and brownish body part (Fig. 2A, B). Orange to the yellowish-red cornea (Fig. 2A, B). Stout and bulky body (Figs 2A, 3A) due to slightly double-flexed pleon antero-dorsally; short carapace, exposed last three thoracic somites, upwards-pointed trapezoid-shaped wing-like extension (Fig. 3A); subtriangular shaped rostrum (Fig. 3B) with broad rounded apex (subtriangular and bluntly pointed) extending between eyes reaching a middle basal segment of antennule peduncle; very large eyes (Fig. 3B), globular; the cornea is wider than eyestalk, covering almost all of the eye surface.

Antennule peduncle (Fig. 3D) with three segments; the basal segment is the longest with a ventral short lobe on subterminal position with three setae; the median segment is the shortest with a ventral short lobe on subterminal position with three setae; the terminal segment is almost 0.5 times as long as the first/basal segment, with eight setae and one plumose seta, hirsute appendix masculina present; inner flagellum with four segments; outer flagellum with 9–10 segments; aesthetascs present. Antennal peduncle (Fig. 3E) is very short and stout, with three segments; antennal scale is extending beyond antennule peduncle, long, robust and broad; suture present at 11–14% from apex; terminal segment with five plumose setae; proximal outer margin without plumose setae from the base of antennal scale is 64%, while proximal inner margin without plumose setae is 27%.

Mandible (Fig. 3F) with incisor and molar process; well-developed lacinia mobilis; the molar process is present; palp with three segments; small basal segment without setae; median segment with eight setae along the outer (lateral) margin and three setae along inner (mesial) margin; terminal segment with six normal setae and four plumose setae. Normal maxilla (Fig. 3G) for the genus; exopod bearing five apical setae; two-segmented endopod, the sub-ellipsoidal shaped terminal segment with seven setae including two normal setae. Normal maxillula (Fig. 3H); basal lobe with nine large spines; precoxal lobe with two long setae and two small setae.

Thoracopods. A round basal plate of thoracic exopod at both distal corners with 7–9 segments with the last 3–4 segments bearing 1–2 plumose setae; robust thoracopods 1–2, slender and elongated thoracopods 3–8; carpopropodus of thoracic endopod 1–8 with 2, 2, 2, 1–2, 3, 1–2, 1, 1 segments, but some segmental borders are not well distinct in thoracopods 3–8; smaller dactylus of thoracopods 3–8 than thoracopods 1–2; nail of thoracopods 3–8 is more slender compared to thoracopods 1–2. The first thoracopod epipod (Fig. 4A) is linguiform-subtriangular without seta; seven-segmented exopod, first four segments without seta, the fifth segment with one plumose seta, the sixth and seventh segments with two plumose setae; normal and robust endopod, densely setose along both lateral margins of the ischium to dactylus, each segment bearing 1–2 plumose setae; nail with a swollen base. Second thoracic exopod (Fig. 4B) with eight segments, last three segments with 1–2 plumose setae; robust thoracic endopod similar to the first thoracopod, but armed with lesser setae, from basis to dactylus bearing 1, 0, 2, 2, 6, 7 setae, respectively.

Third thoracic exopod (Fig. 4C, D) with nine segments, the last four segments with 1–2 plumose setae; thoracic endopod is more slender and elongate instead of robust, two-segmented carpopropodus, all segments are armed with setae, dactylus is smaller than in thoracopods 1–2, the nail is more slender than first and second thoracopods. The fourth thoracic endopod (Fig. 4E) is similar to the third thoracopod, carpopropodus, with 1–2 segments. The fifth thoracic endopod (Fig. 4F) is slightly longer than in the fourth thoracopod, merus nearly equal in length to the preceding segment, three-segmented carpopropodus, elongated and slender nail. Eighth thoracic exopod (Fig. 4G) with seven segments; thoracic endopod is smaller and more slender than other thoracopods, merus is longer than the preceding segment, separate carpopropodus, short and small dactylus, the nail is shorter than other thoracopods.

Pleopods. Pleopods 1, 2, 3 and 5 (Fig. 5A, C, E) reduce to simple separate plates, each with 4–6 setae of different lengths, longer than width; length of pleopod is more than twice its width. Male pleopod 4 (Fig. 5D) has distinct endopod and exopod, both undivided and basal-

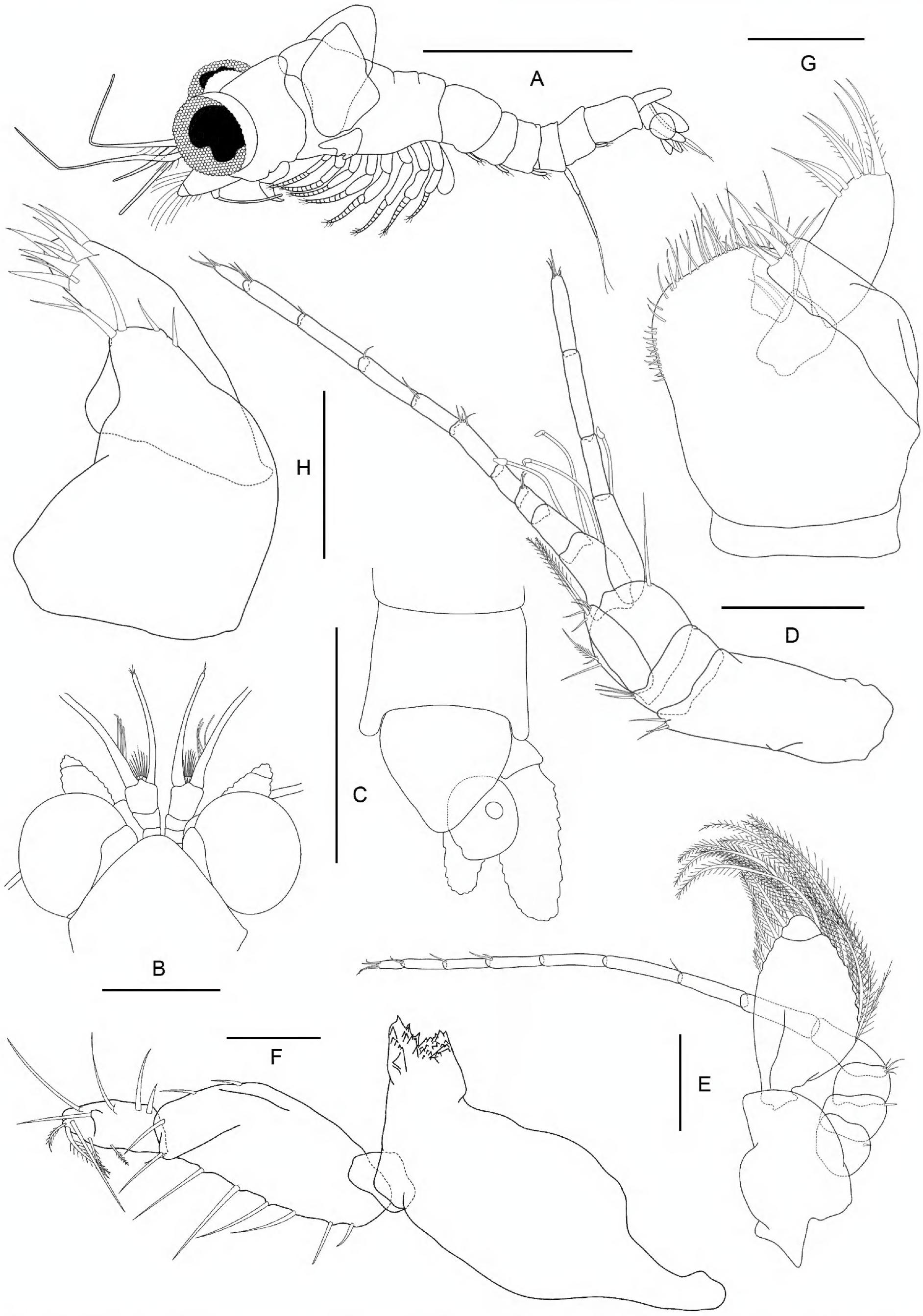

Figure 3. *Idiomysis bumbumiensis* sp. nov., holotype (BL. 2.3 mm, UKMMZ-1611). **A.** Habitus; **B.** Anterior body, dorsal view; **C.** Posterior body, dorsal view; **D.** Antennule, obliques dorso-lateral view; **E.** Antennal; **F.** Mandible; **G.** Maxilla; **H.** Maxillula. Scale bars equal 0.1 mm for D–E; 1 mm for A; 0.4 mm B–C; 0.05 mm for F–H.

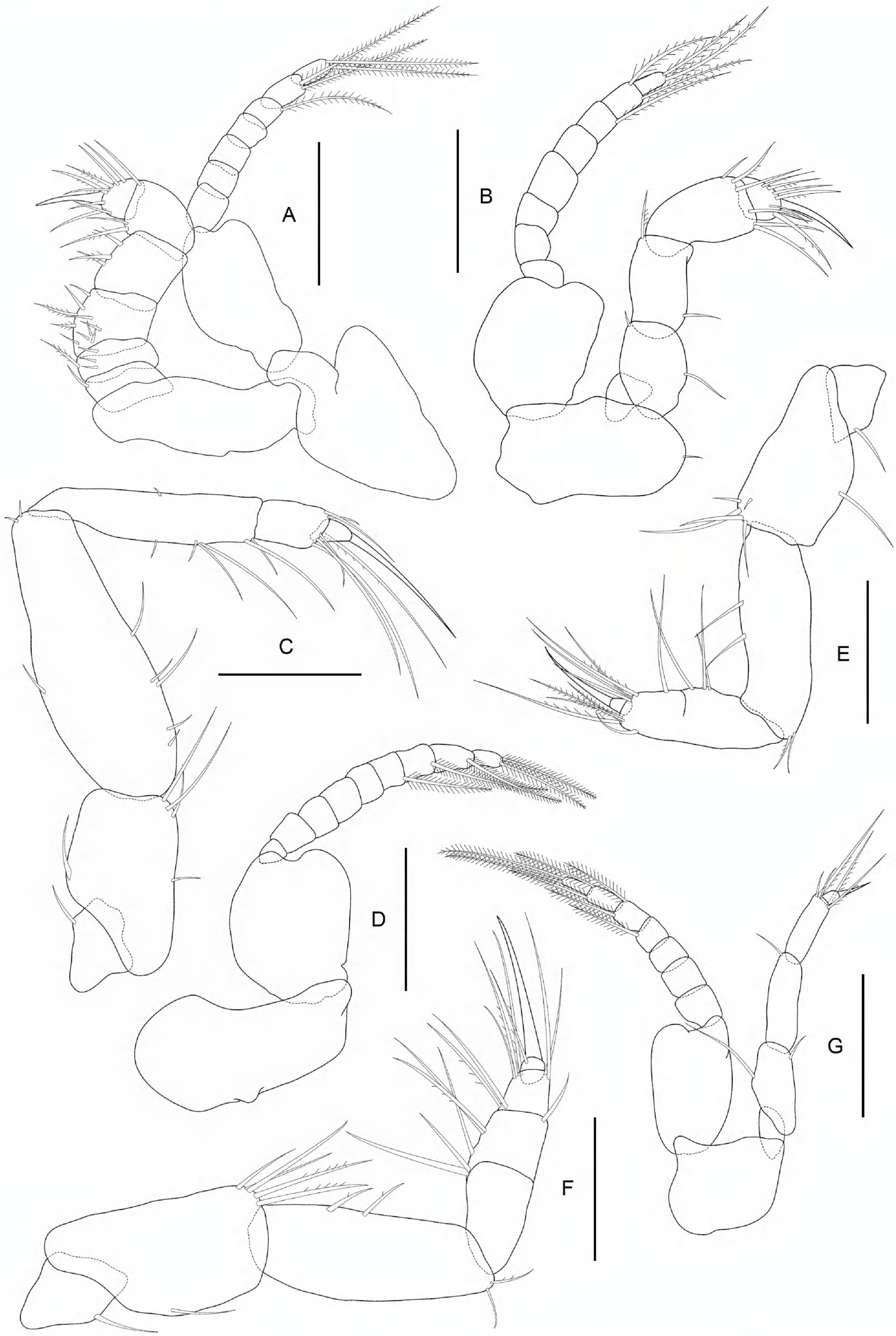

Figure 4. *Idiomysis bumbumiensis* sp. nov., holotype (BL. 2.3 mm, UKMMZ-1611). **A.** First thoracopod; **B.** Second thoracopod; **C.** Third thoracic endopod; **D.** Third thoracic exopod; **E.** Fourth thoracic endopod; **F.** Fifth thoracic endopod; **G.** Eighth thoracopod. Scale bars equal 0.1 mm for A–G.

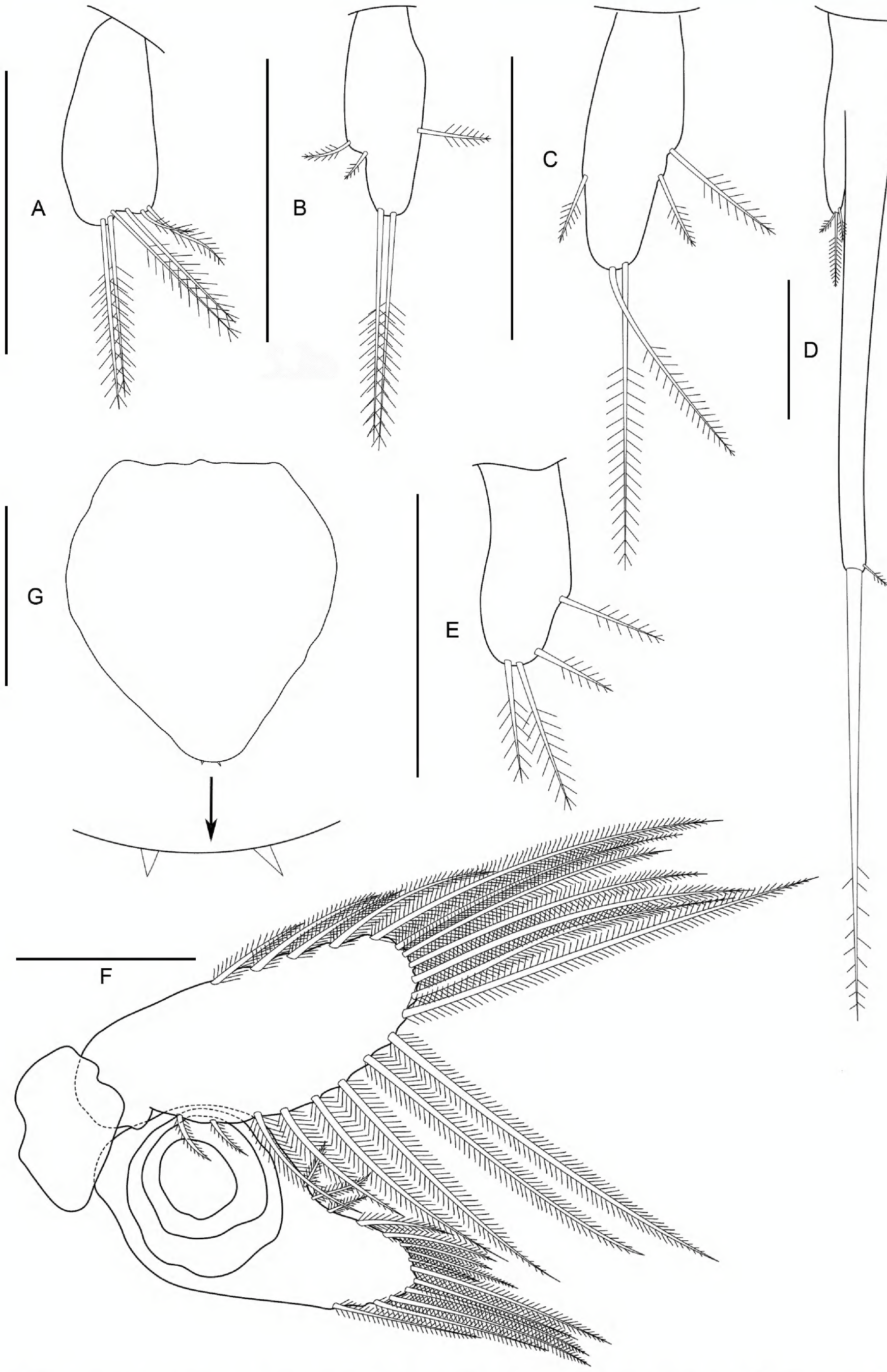

Figure 5. *Idiomysis bumbumiensis* sp. nov., holotype (BL. 2.3 mm, UKMMZ-1611). **A.** Pleopod 1; **B.** Pleopod 2; **C.** Pleopod 3; **D.** Pleopod 4; **E.** Pleopod 5; **F.** Uropod; **G.** Telson. Scale bars equal 0.1 mm for A–G.

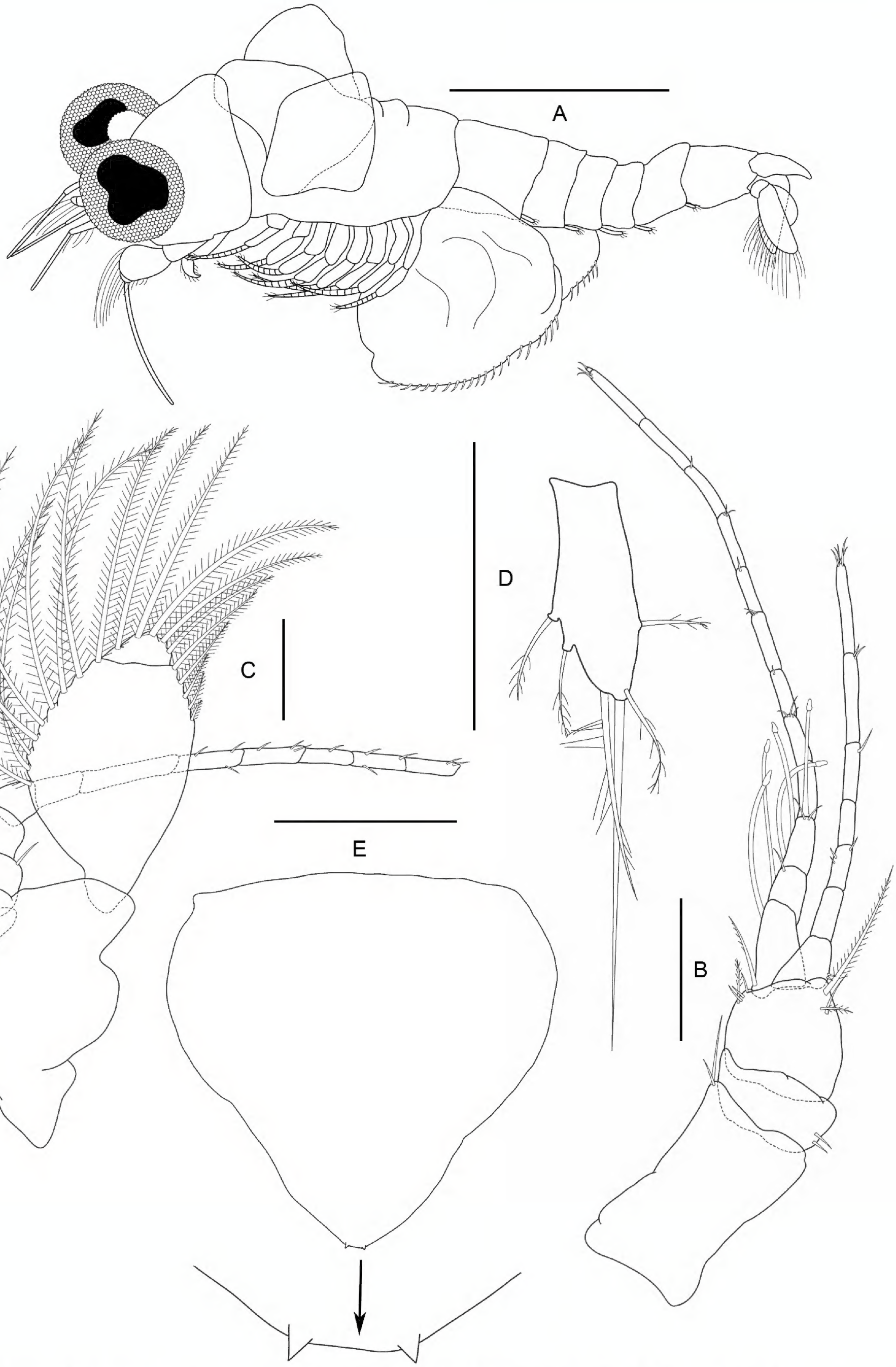

Figure 6. *Idiomysis bumbumiensis* sp. nov., allotype (BL. 3.2 mm, UKMMZ-1612). **A.** Habitus; **B.** Antennule, oblique dorso-lateral view; **C.** Antennal; **D.** Pleopod 4; **E.** Telson. Scale bars equal 0.1 mm for B–E; 1 mm for A.

ly not separated by sutures; endopod with three plumose setae; exopod has one small terminal seta and a large-barbed seta (armed with a few setules).

Uropod and telson. Uropod (Figs 3C, 5F) has a shorter endopod than exopod; both endopod and exopod have plumose setae all around, without setae on both margins of the proximal part of endopod and exopod; endopod with 14 plumose setae; exopod with 19 plumose setae; large statocyst (there are circular borders between ambitus versus tegmen and ambitus versus fundus). Telson (Figs 3C, 5G) is approximately 1.12 times longer than the width and 0.8 times longer than the sixth abdominal somite; short, subtriangular with rounded tip; extending halfway across statocyst of endopod; smooth margin, except for apex with a pair of minute spines.

Female. Similar to male, except for the following differences: stouter and bulkier body (Fig. 6A) than male due to marsupium; marsupium of female on the eighth thoracopod is larger than seventh thoracopod, large with short setae along the distal margin. Antennule (Fig. 6B); inner flagellum with seven segments; outer flagellum with 12 segments; aesthetascs is present. Antennal scale (Fig. 6C) with suture present at 10%–14% from apex; from the base of antennal scale, 70% of the proximal outer margin is without plumose setae while 45% of the proximal inner margin is without plumose setae. Pleopod 4 (Fig. 6D) is similar to male pleopods 1–3, 5; longer than its width with six setae. Telson (Fig. 6E) is approximately 1.03 wider than its length; apex with a pair of minute spines.

Etymology. The specific epithet refers to the type locality; Pulau Bum Bum, Sabah, Borneo, Malaysia.

Colouration in freshly fixed specimens (based on UKMMZ-1611, BL. 2.3 mm; UKMMZ-1612, BL. 3.2 mm; Fig. 2A, B). Zesty orange eyes. Antennal scale, carapace including thoracic and translucent abdominal somites with a combination of small orange, yellow and black patches.

Remarks. The present species is the seventh member of the genus *Idiomysis*, but it is the first species of this genus to be described in Southeast Asia. It is also the third species of the tribe Anisomysini found in Malaysian waters besides *Anisomysis* (*Anisomysis*) *aikawai* Ii, 1964 and *A.* (*Paranisomysis*) *ohtsukai* Murano, 1994 (Moriya 2016; Tan and Azman 2018). The genus *Idiomysis* can be easily classified into two groups, based on the antennal scale; (i) entire or (ii) 2 segments. *Idiomysis inermis*, *I. mozambica*, *I. robusta* and *I. tsurnamali* are in the group of an entire antennal scale, while *I. diadema* and *I. japonica* are in the group of two-segmented antennal scale. The presence of the spine, which is exclusively in *I. robusta*, distinguishes the group with the entire antennal scale. The present new species, *Idiomysis bumbumiensis* sp. nov., has two antennal scale segments, similar to *I. diadema* and *I. japonica*. However, they can be differentiated by observing the apex of the telson. Both *I. diadema* and *I. bumbumiensis* sp. nov have a pair of minute apical spines exclusive to these two species; on the other hand, *I. japonica* has a bluntly rounded telson apex. The endopodal uropod in *I. diadema* shows a clear extension beyond the exopod, but this structure is shorter than the exopod in *I. bumbumiensis*.

Key to species of the genus *Idiomysis* (Based on males)

1	Not segmented antennal scale	2
–	Antennal scale with two segments	5
2	Broadly rounded rostrum	3
–	Triangular or subtriangular rostrum	4
3	Not segmented antennal scale, with spine	*I. robusta*
–	Not segmented antennal scale, without spine	*I. inermis*
4	Endopodal uropod is subequal to exopod	*I. mozambica*
–	Endopodal uropod is clearly shorter than exopod	*I. tsurnamali*
5	Bluntly rounded telson apex	*I. japonica*
–	Telson apex with a pair of minute spines	6
6	Endopodal uropod clearly extends beyond exopod	*I. diadema*
–	Endopodal uropod is shorter than exopod	*I. bumbumiensis* sp. nov.

Discussion

Idiomysis bumbumiensis sp. nov. is the sole representative of this genus in Southeast Asian waters. *Idiomysis bumbumiensis* sp. nov. was relatively abundant and easily found in the shallow water of lower than 15 m during night-sampling sessions (28 November 2018 and 29 November 2018). As they were directly collected using SCUBA diving equipment, supplementary information on their natural habitat and body colour is available. The recently described *Cerapus bumbumiensis* Nurshazwan, Ahmad-Zaki & Azman, 2020 was also observed in the accompanying fauna. Although one species of *Idiomysis* was categorically described in this paper, fellow macro-photographers discovered further evidence of at least two other distinctive species of *Idiomysis* in the vicinity.

Idiomysis lives either in a symbiotic relationship (*Idiomysis diadema*, *I. inermis* and *I. tsurnamali*) or

Table 1. Morphological variation of seven species of the genus *Idiomysis*, including the new species.

Characters	*I. diadema* Wittmann, 2016	*I. inermis* W. M. Tattersall, 1922	*I. japonica* Murano, 1978	*I. mozambica* Deprez, Wooldridge & Mees, 2001	*I. robusta* Connell, 2008	*I. tsurnamali* Băcescu, 1973	*I. bumbumiensis* sp. nov. (Present study)
Body length	Male: 2.2–2.3	Male: 3.4–4.4	Male: 3.3	Male: 2.9–3.9	Male: 4.9–6.0	Male: 4.2–4.5	Male: 2.0–2.3
	Female: 2.2–3.3	Female: 4.0–5.0	Female: 3.7–3.9	Female: 2.6–2.9	Female: 4.8–5.4	Female: 4.2–4.5	Female: 2.2–3.2
Rostrum	Broadly rounded	Broadly rounded	Subtriangular (bluntly pointed)	Subtriangular (bluntly pointed)	Broadly rounded	Triangular (pointed)	Subtriangular (bluntly pointed)
Antennal scale	Two segments (no spine)	Entire (no spine)	Two segments (no spine)	Entire (no spine)	Entire (spine)	Entire (no spine)	Two segments (no spine)
Segments of thoracic exopod 1–8	6–8	7–10	7–8	7–9	7–8	5–8	7–9
Male pleopod 4 exopod	Single segment	Single segment	Single segment	Two segments	Single segment	Single segment	Single segment
Endopodal uropod	Clearly extend beyond exopod	Subequal to exopod	Subequal to exopod	Subequal to exopod	Shorter than exopod	Clearly shorter than exopod	Shorter than exopod
Telson apex	A pair of minute spines	Bluntly rounded	Bluntly rounded	Bluntly rounded	Bluntly rounded	Bluntly rounded	A pair of minute spines
Length ratio of fifth to sixth abdominal somite	0.5	0.5	0.5	0.4	0.4	0.5	0.6
Length ratio of telson to last abdominal somite	1.0	0.8–0.9	0.8	0.4	0.8	0.8	0.8
Distribution	Coast of Sinai at Dahab, Red Sea	Kilakarai, Gulf of Manaar & Moreton Bay, Australia	Nagasaki, Japan	Nacala Bay, Mozambique	Park Rynie, East Coast of South Africa	Gulf of Eilat, Red Sea	Pulau Bum Bum, East Malaysia
Occurrence	Swarms between spines of sea urchin	Amongst weeds, sea anemone	Near rocky bottom	Near uneven rock and patches of sand	Near sandy substrate, amongst rocks and low-profile reef	Hovering over medusa or sea anemone	Near coral ledge; silty substrate
Depth range	1–8 m	1–4 m	1–5 m	4 m	2–38 m	1–20 m	10–11 m

free-living (*I. japonica*, *I. mozambica* and *I. robusta*). *Idiomysis bumbumiensis* is a free-living mysid that was found swimming in a swarm on the silty substrate. By comparing the body lengths of all the species of the genus *Idiomysis*, this new species is one of the smallest species, besides *I. diadema*. Another feature that distinguishes species within the genus *Idiomysis* is the length ratio between the telson and the last abdominal somite. As this feature has not been described for the six known species, the ratios are calculated, based on the original-drawn figures describing each species. The ratio is mostly 0.8–1.0, except for *I. mozambicus*, which has a ratio of 0.4. The ratio of the present species is 0.8. Thus, the telson of most *Idiomysis* species is estimated to be more than 4/5 times as long as the last abdominal somite, while *I. mozambicus* is 2/5 times as long as the last somite. As shown in Table 1, *I. bumbumiensis* sp. nov. can be distinguished from *I. inermis* and *I. tsurnamali* by several morphological features: two segments of antennal scale and a pair of minute spines on the apex of the telson. Table 1 shows a brief morphological variation from each species of the genus *Idiomysis*. More research would be required to uncover more underwater macrolife, particularly in this area known as the heart of the Coral Triangle. More unique and unidentified marine life would undoubtedly be discovered with the overwhelming support of local underwater photographers.

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